

STATE OF ALASKA

*Jay S. Hammond, Governor*

Annual Performance Report for

POPULATION STUDIES OF GAME FISH AND  
EVALUATION OF MANAGED LAKES IN THE  
SALCHA DISTRICT WITH EMPHASIS ON BIRCH LAKE

by

*Michael Doxey*

ALASKA DEPARTMENT OF FISH AND GAME

*Ronald O. Skoog, Commissioner*

SPORT FISH DIVISION

*Rupert E. Andrews, Director*

## TABLE OF CONTENTS (Cont'd.)

	Page
Table 13. Population estimates for Arctic grayling in two sections of the Goodpaster River, June 24-27, 1980 . . . . .	27
Table 14. A comparison of population estimates for Arctic grayling in the lower Goodpaster River for 1973-1980 . . . . .	28
Table 15. Age frequency and length of Arctic grayling captured in two sections of the Goodpaster River, June, 1980 . . . . .	29
Table 16. Length frequency of Arctic grayling captured in two sections of the Goodpaster River, June, 1980 . . . . .	31
Table 17. A comparison of fish capture rates using a boat mounted shocker, Goodpaster River, 1973-1980 . . . . .	32
Table 18. Summary of fish captured in the Ladue River, June, 1980 . . .	34
Table 19. Age frequency and length of Arctic grayling, Ladue River, June, 1980 . . . . .	35

Job No. G-III-K    Population Studies of Game Fish and Evaluation of  
                          Managed Lakes in the Salcha District with Emphasis  
                          on Birch Lake  
                          By: Michael Doxey

Abstract . . . . .	38
Background . . . . .	39
Birch Lake . . . . .	39
Harding Lake . . . . .	42
Little Harding Lake . . . . .	42
Lost Lake . . . . .	42
Koole Lake . . . . .	43
"Spencer" Lake . . . . .	43
Recommendations . . . . .	43
Management . . . . .	43
Research . . . . .	44
Objectives . . . . .	44
Techniques Used . . . . .	44
Findings . . . . .	46
Birch Lake . . . . .	46
Harding Lake . . . . .	53
Lost Lake . . . . .	56
Koole Lake . . . . .	56
"Spencer" Lake . . . . .	56
Little Harding Lake . . . . .	58
Literature Cited . . . . .	59

## LIST OF FIGURES

Figure 1. Delineation of study area . . . . .	40
Figure 2. Average Weekly Surface Water Temperatures, Birch Lake, 1980 .	54
Figure 3. Spencer Lake . . . . .	57

# TABLE OF CONTENTS (Cont'd.)

Page

## LIST OF TABLES

Table 1.	Scientific and common names of fish mentioned in this report . . . . .	41
Table 2.	Birch Lake summer creel census - 1980. Fishing pressure and rainbow trout catch statistics by age class . . . . .	47
Table 3.	Comparison of catch by age class for rainbow trout in Birch Lake-summer 1979 and summer 1980 . . . . .	48
Table 4.	Total effort and CPUE comparisons of 1979 and 1980 summer fishery for Birch Lake rainbow trout . . . . .	48
Table 5.	Miscellaneous information about Birch Lake fishery, summers of 1979 and 1980 . . . . .	50
Table 6.	Ratios of Age I Birch Lake rainbow trout kept and released by anglers through the summer of 1980, and length data . . . . .	50
Table 7.	Growth comparison of Age I Swanson and Ennis-Alaska strain rainbow trout-Birch Lake-May to October . . . . .	52
Table 8.	Mean condition factors for Birch Lake Age I Ennis-Alaska rainbow trout in 1980 . . . . .	52
Table 9.	Dissolved oxygen and temperature profiles - Birch Lake, 1980 . . . . .	55

## RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations  
of Alaska

Project No.: F-9-13

Study No.: G-III Study Title: LAKE AND STREAM INVESTIGATIONS

Job No.: G-III-K Job Title: Population Studies of Game Fish  
and Evaluation of Managed Lakes  
in the Salcha District with  
Emphasis on Birch Lake

Cooperator: Michael Doxey

Period Covered: July 1, 1980 to June 30, 1981

## ABSTRACT

This report presents second year (1980) findings of a multi-year study to evaluate and compare the newly available Swanson River strain rainbow trout, Salmo gairdneri Richardson, with long established hatchery strains. Data are provided on growth, survival and contribution to the sport harvest in an interior Alaska lake.

A population estimate showed a survival to early October of 53.8 percent of the 55,074 Swanson River strain rainbow trout stocked into Birch Lake in late May and early June.

Summer creel census at Birch Lake indicated that fishermen spent an estimated 22,290 man-hours from May 19 to September 1 to catch 7,602 rainbow trout. Catch per unit effort during the period varied from 0.27 to 0.50 fish per hour. As in 1979, subcatchable rainbow trout planted in May contributed increasingly to the creel as the summer progressed. Comparisons are presented between 1979 and 1980 creel census data. A limited winter creel census on Birch Lake indicated that fishermen spent 12,631 man-hours to catch 10,358 rainbow trout from December 1, 1979 to April 27, 1980.

The warm water bacteria-related "popeye" condition that appeared in the Ennis-Alaska strain rainbow trout in Birch Lake in 1979 reappeared in those fish. None of the Swanson River strain rainbow trout were afflicted. Limnological data are presented for Birch Lake.

Test netting in Harding Lake indicated low survival of stocked coho salmon, Oncorhynchus kisutch (Walbaum) and an increase in the relative abundance of

least cisco, Coregonus sardinella Valenciennes. Data are presented on the growth and stocking of coho salmon in Little Harding and Lost Lakes. The stocking and availability of rainbow trout in Koole Lake is discussed.

Pre-stocking evaluations of "Spencer" Lake were continued, and limnological data are presented.

## BACKGROUND

### Birch Lake

Birch Lake is an 803 surface acre lake located 56 mi southeast of Fairbanks on the Richardson Highway. Its lightly brown-stained waters have a maximum depth of 49 ft.

The U.S. Air Force maintains a recreation camp on Birch Lake. Heavy summer use of this camp contributes significantly to angler pressure. There is a state parking and boat launching area along the eastern shoreline, and a turnoff and parking area where the highway swings past the south end of the lake. About half the shoreline of the lake is private land with cabins. The lake has four small inlets. The single outlet has a fish and water level control structure on it.

Birch Lake was chemically rehabilitated in 1966 to remove humpback whitefish, least cisco, burbot, slimy sculpin, and stunted northern pike, and was stocked with fingerling rainbow trout. Since that time, a popular summer and winter sport fishery has been maintained by stockings of rainbow trout and coho salmon fingerlings and sub-catchable rainbow trout.

Figure 1 delineates the study area. Table 1 lists the common and scientific names and abbreviations of fish mentioned in this report.

Lake chubs and slimy sculpins have appeared in the lake, probably due to vandalization of the outlet structure in 1967. The chubs have attained such a high population level that they are now a problem.

An evaluation of the Birch Lake rainbow trout fishery and a comparison of the stocking suitability of the Ennis-Alaska strain and the Swanson River strain rainbow trout was launched in the spring of 1979. Summer creel census indicated that the 101,314 sub-catchable Ennis-Alaska strain rainbow stocked in May, 1979 contributed increasingly to the creel as the summer progressed, and that 1,420 had been caught and kept by early September. Throughout the summer, fishermen spent 16,324 man hours angling to catch 4,473 rainbows of all age classes and 138 terminal-year coho salmon. Fishing success increased greatly after freeze-up. A fall population estimate showed a survival to October of 20.8% of the rainbows stocked in the spring. A "popeye" disease, apparently related to warm water bacteria, appeared in the Ennis-Alaska strain fish during the summer of 1979.

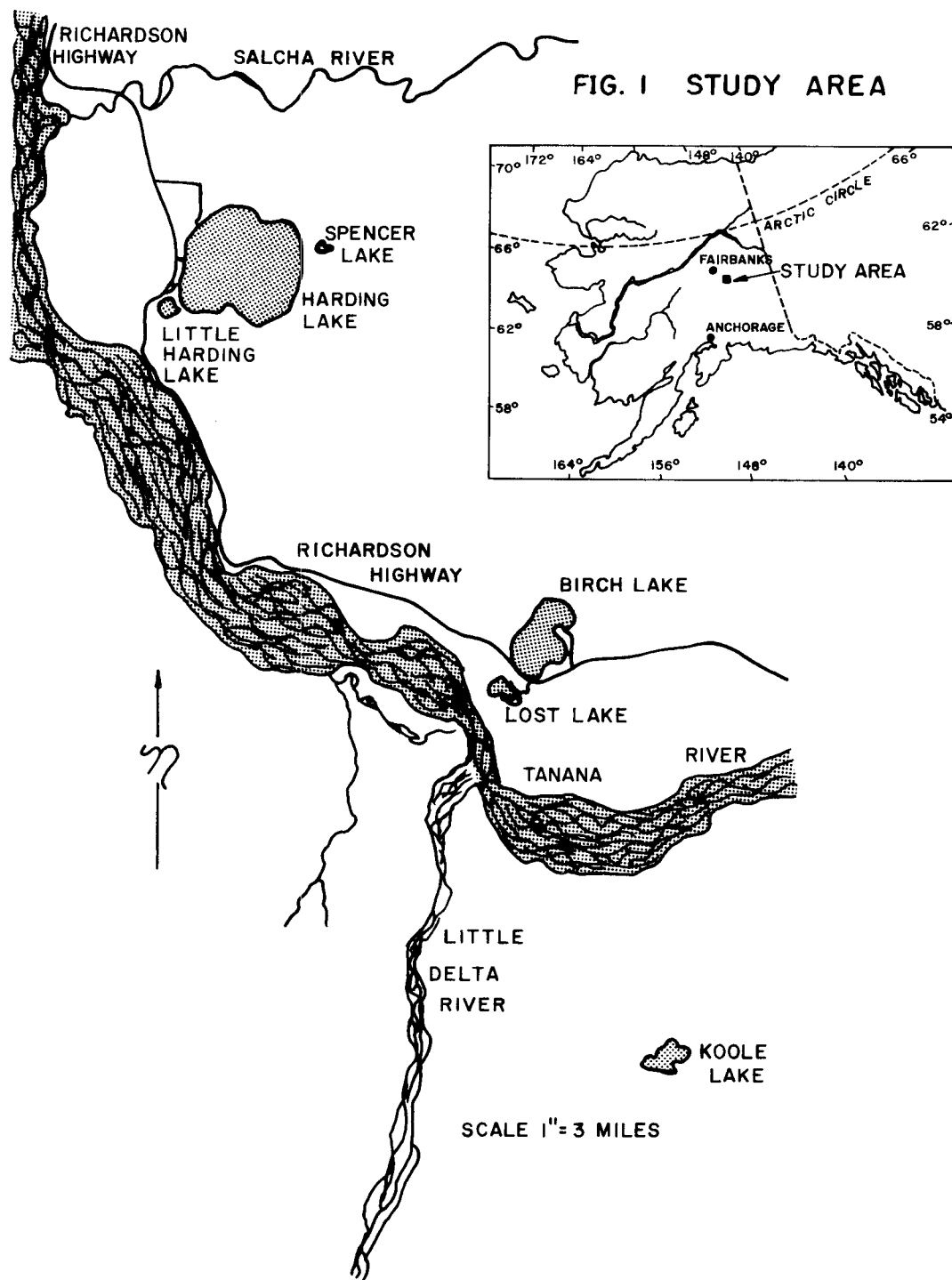


Figure 1. Delineation of study area.

Table 1. Scientific and common names of fish mentioned in this report.

Common Name	Scientific Name and Author	Abbreviation
Burbot	<u>Lota lota</u> (Linnaeus)	BB
Chinook salmon	<u>Oncorhynchus tshawytscha</u> (Walbaum)	KS
Coho salmon	<u>Oncorhynchus kisutch</u> (Walbaum)	SS
Humpback whitefish	<u>Coregonus pidschian</u> (Gmelin)	HWF
Lake chub	<u>Couesius plumbeus</u> (Agassiz)	LC
Lake trout	<u>Salvelinus namaycush</u> (Walbaum)	LT
Least cisco	<u>Coregonus sardinella</u> Valenciennes	LCI
Longnose sucker	<u>Catostomus catostomus</u> (Forster)	LNS
Northern pike	<u>Esox lucius</u> Linnaeus	NP
Rainbow trout	<u>Salmo gairdneri</u> Richardson	RT
Slimy sculpin	<u>Cottus cognatus</u> Richardson	SSC

### Harding Lake

Harding Lake is located 45 mi southeast of Fairbanks along the Richardson Highway. The transparent green, 2,470 acre lake has a maximum depth of 142 ft. There are two inlets but no visible outlet. Climatological trends and drainage changes have reduced the level of the lake about 3 ft since the mid-1960's, drying up large areas used by pike for spawning and summer habitat at the north end of the lake.

The indigenous fish in the lake include northern pike, burbot, least cisco and slimy sculpin. Lake trout were introduced into the lake in 1939, 1963 and 1965 as adults and in 1967 as fingerlings. Coho salmon were stocked into the lake intermittently from 1968 until 1978, both as fingerlings and as smolts.

While stocked coho salmon and lake trout attain a large size in Harding Lake, survival of cohos is low and lake trout have failed to reproduce. Thus the contribution of stocking to a sport fishery has been negligible (Hallberg, 1979). Pike and burbot remain the basis of sport fishing in the lake.

Hallberg described a decline in the relative abundance of least cisco from numbers caught during test netting in the early 1970's.

### Little Harding Lake

Little Harding Lake is a 54 surface acre lake located adjacent to Harding Lake, 45 mi down the Richardson Highway from Fairbanks. The maximum depth is 28.5 ft. The water is brown-stained and the edges of the lake are swampy. A single outlet empties into Harding Lake. There are control structures at both ends of the outlet to prevent fish movement into or out of Little Harding Lake.

Little Harding Lake was first rehabilitated in 1966 to remove stunted northern pike and was then stocked with coho salmon. Reintroduction of pike into the lake necessitated rehabilitation again in 1976, followed by the stocking of 48,400 coho fingerlings that same year. Kramer (1978) and Hallberg (1979), found very high survival of these fish.

Little Harding Lake has produced a popular winter fishery for coho salmon. In the summer of 1978, 9,500 chinook salmon fingerlings were stocked into the lake, and in the summer of 1979 15,000 coho fingerlings weighing 140 per pound were stocked.

### Lost Lake

Lost Lake is a 102 acre lake located 56 mi southeast of Fairbanks on the Richardson Highway. It is about 1/2 mi southwest of Birch Lake. The brown-stained waters have a maximum depth of 39 ft. There is a single outlet stream and a fish control structure blocks it.



Lost Lake has been rehabilitated three times (last in 1970). Stockings of coho salmon and rainbow trout have produced an intermittently successful sport fishery; efforts to maintain the sport fishery have been somewhat thwarted by vandalism of the weir on the outlet stream, which lets out the stocked fish and permits entry of undesirable species. In the spring of 1979, the lake was inhabited by coho salmon, lake chubs, and longnose suckers. In July 1979, 30,000 coho salmon at 140 per pound were stocked into the lake.

#### Koole Lake

Koole Lake is a 320 surface acre lake lying in the Tanana flats 8 mi south-east across the Tanana River from Birch Lake. It has a large shoal area, and a maximum depth of 22 feet. The water is transparent brown and much of the shoal area supports lily pads and emergent aquatic vegetation.

Access to the lake is by snowmachine or light aircraft. There is one intermittent outlet, blocked by an old beaver dam. The land surrounding the lake is primarily military land and there are no roads or cabins in the area.

Koole Lake contained no native fish species. It was stocked with rainbow trout in 1974 and has provided a popular fly-in fishery.

A brief trip to Koole Lake in June 1979 indicated that the lake has good sport fishing potential for 16 in, 1 1/2 pound rainbows (Doxey, 1980).

#### "Spencer" Lake

"Spencer" Lake is an approximately 11 acre lake lying 3/8 mi east of Harding Lake. A brief survey in August 1979 revealed a population of small northern pike and encouraged the staff to continue evaluating the lake for possible rehabilitation and stocking (Doxey, 1980). The lake has no apparent inlet. A small, swampy outlet drains toward Harding Lake.

### RECOMMENDATIONS

#### Management

1. Birch Lake should be maintained as a sport fishery for rainbow trout and coho salmon.
2. The stocking program of planting sub-catchable, Age I rainbow trout into Birch Lake should be continued.
3. Lost and Little Harding Lakes should be maintained as coho salmon fisheries. Little Harding Lake should be stocked with cohos in the summer of 1981.

## Research

1. The evaluation of the survival and catchability of Swanson River strain rainbow trout in Birch Lake should continue.
2. The evaluation of coho salmon growth, survival, catchability, and stocking practices in Birch, Lost and Little Harding Lakes should continue.
3. Methods of improving sport fishing in Harding Lake should be investigated.
4. Studies should proceed on "Spencer Lake" to determine the feasibility of rehabilitation and which species of sport fish to restock in the lake.

## OBJECTIVES

1. To determine limnological conditions that affect survival and growth of stocked game fish in lakes of the district, with emphasis on Birch Lake.
2. To evaluate survival, growth, and contribution to the creel (both winter and summer) of two strains of rainbow trout in Birch Lake and to determine optimum stocking parameters.
3. To evaluate stocks of coho salmon in Harding, Little Harding, and Lost Lakes to determine their population status, growth, and interaction with other fish species present in these lakes.
4. To determine the feasibility of controlling an infestation of lake chubs in Birch Lake.
5. To monitor other sport fisheries in the district, as they develop.
6. To conduct a preliminary analysis of the feasibility of stocking "Spencer" Lake, a small lake northeast of Harding Lake.

## TECHNIQUES USED

An electrofishing unit based on the boat-mounted unit described by Van Hulle (1968) and Roguski and Winslow (1969) was used for obtaining part of the rainbow trout population estimate in Birch Lake.

Multifilament and monofilament sinking or floating gill nets measuring 125 x 6 ft and consisting of five 25-ft panels of 0.5-2.5 in bar mesh were used to monitor fish populations in Lost, Harding, and Little Harding Lakes.

Gill nets were set at varying depths and habitats on both the bottom and surface.

A 270 ft bag seine, composed of several 30 to 100 ft x 6 ft seines and one 50 x 8 ft bag seine tied end to end, was used to seine rainbow trout in Birch Lake. The seine was pulled out from shore circling back to shore by boat, then pulled in by hand.

Fyke nets measuring 20 ft in length by 4 ft diameter with 3/8 in knotless nylon webbing and 50 to 100 ft x 4 ft center leads were set along the shoreline of Birch Lake to capture fish for population estimates and other studies.

For the Birch Lake rainbow trout population estimate, captured fish were marked by fin clips and released. Different fin clips were used in different areas of the lake to determine the degree of mixing. Numbers of marked and unmarked fish were tabulated upon recapture, and population estimates and confidence limits were determined using Schnabel multiple mark and recapture estimates.

For growth studies, Birch Lake rainbow trout and coho salmon were collected monthly, and coho salmon were collected in Lost and Little Harding Lakes twice during the open water season. The fish were measured to the nearest millimeter of fork length and weighed to the nearest gram on a triple beam balance or Chatillon IN-2 spring scale. Larger fish were weighed on a Chatillon IN-25 spring scale. Scales used for age determination were individually cleaned and mounted between glass slides or were mounted on 20 mil acetate using a Carver press at 20,000 psi, heated to 200°F for 30 seconds. The scales were read on a Bruning 200 microfiche reader. Condition factors were determined by the formula  $K = W \div FL^3 \times 10^3$ , where K= condition factor, W=weight in grams, and FL= fork length in millimeters.

Birch Lake nearshore water temperatures were recorded continuously through most of the summer by a Ryan thermograph. Thermograph temperatures were calibrated and verified through spot checks with conventional thermometers.

Water chemistry data were collected using a Hach AL-36B field test kit. Dissolved oxygen and temperature profiles were collected using a YSI Model 54 APB dissolved oxygen and temperature meter.

A summer creel census program was set up at Birch Lake. Weeks were stratified according to predicted intensive use periods on Saturdays, Sundays, and holidays, and predicted light use periods on weekdays. Three random fisherman counts were taken during weekend intensive use periods and a minimum of one count was made at random on weekdays. Two or three counts were made during holiday intensive use periods. Immediately after one of the weekend fisherman counts, most or all of the fishermen were interviewed. Notes were made on the number and size composition of the rainbow trout in the catch, and on the time spent angling. Notes were also taken on whether anglers were fishing from shore or from a boat, whether they were civilian or military, and on weather conditions.

A limited winter creel census was also conducted at Birch Lake. Similar information was gathered.

The instantaneous angler counts were expanded to yield an estimate of angler hours during the periods. These estimates were then adjusted for known weather and darkness conditions to obtain the final estimate. Catch per unit effort (CPUE) data, expressed as fish per angler hour, were obtained from the interviews.

## FINDINGS

### Birch Lake

#### Winter Creel Census:

The limited winter creel census was conducted on weekends from December 12, 1979 to February 24, 1980. Data were expanded to an estimate covering the period of December 1 through April 27, after which the ice became unsafe for fishermen. Ice fishermen generally are able to drive automobiles on the ice of Birch Lake starting in December. They either fish in the open using the car for warmth and shelter, or they use an ice fishing shanty. During the winter of 1979-1980 thirty-one fishing shantys were registered with the Fairbanks (ADF&G) office for use on Birch Lake.

Fishermen spent an estimated total of 12,631 man-hours to catch 10,358 rainbow trout for an overall CPUE of 0.82 fish per hour. Age II and older rainbows contributed 1,137 fish (0.09 fish per hour) to the creel, and the Ennis-Alaska yearlings contributed 9,221 (0.73 fish per hour).

Overall CPUE during the weekends sampled varied from 0.48 to 2.59 fish/hr, with the best fishing occurring in early winter.

#### Summer Creel Census:

The 1980 summer creel census was conducted from May 19 to September 1. A total of 492 anglers was interviewed during the summer. An estimate of angler pressure and catch by age class of rainbow trout is shown in Table 2. The total of 22,290 estimated man hours is up 40% from the 1979 total of 16,324 (Doxey, 1980). The average number of anglers on the lake during weekend counts in 1980 was 35, up 34% from the average of 26 in 1979. Effort was highest in early summer, and declined thereafter, as it did in 1979. There were no catchable size coho salmon in Birch Lake in 1980.

Catch per unit effort increased steadily, in contrast to 1979, when it remained fairly stable until September. The contribution of Age III and older fish to the creel continued its steady decline seen in 1979, and Age II fish were again the basis of the fishery. Tables 3 and 4 compare the totals from Table 2 with the equivalent results from the 1979 summer creel census. As in 1979, the total contribution of Age II fish to the creel in 1980 was 66%. The CPUE of Age II fish in 1980 declined steadily throughout the summer, as in 1979, and, similarly, by late summer the Age I trout were the major contributors to the creel.

Table 2. Birch Lake summer creel census - 1980. Fishing pressure and rainbow trout catch statistics by age class.

Period	Man Hours	Fish/ Hour	Age III & Older		Age II		Age I		Total
			Percent	Number	Percent	Number	Percent	Number	
May 19 thru June 29	12,775	0.27	20.9	721	78.0	2,690	1.1	39	3,450
June 30 thru July 31	6,064	0.40	15.9	143	73.5	1,784	20.6	499	2,426
August 1 thru September 1	3,451	0.50	1.5	26	31.3	541	67.2	1,159	1,726
Totals	22,290	0.34	11.7	890	66.0	5,015	22.3	1,697	7,602

Table 3. Comparison of catch by age class for rainbow trout in Birch Lake-summer 1979 and summer 1980.

Dates	Age III & Older		Age II**		Age I	
	Number	Percent	Number	Percent	Number	Percent
May 27 thru September 3, 1979*			3,053	66	1,420	31
May 19 thru September 1, 1980	890	11	5,015	66	1,697	22

\* 1979 Percentages do not show 138 coho salmon, which comprised the other 3.0% of the catch.

\*\* Age II and older in 1979

Table 4. Total effort and CPUE comparisons of 1979 and 1980 summer fishery for Birch Lake rainbow trout.

Dates	Man-Hours	CPUE	Total Catch
May 27 thru Sept. 3, 1979	16,324	0.28 fish/hr	4,473
May 19 thru Sept. 1, 1980	22,290	0.34 fish/hr	7,602

A higher percentage of anglers fished from the shore in 1980 than in 1979, and they were slightly more successful (Table 5). The percentage of military fishermen increased significantly in 1980, as did their success (Table 5).

In June, the mean fork length of the yearling rainbow trout was 140 mm (range 104-195 mm). At that time anglers kept 10.3% of the Age I rainbow trout caught (Table 6). By late August 83% of the yearlings being caught were kept. Their mean length at that time was 179 mm (range 136-233 mm).

The combined totals from the winter and summer creel census show that anglers spent 34,921 man-hours to catch 17,960 rainbow trout from December 1979 to September 1980.

#### Population Estimate:

On May 23, 1980, 50,000 yearling Swanson River strain rainbow trout weighing 18 per pound were stocked in Birch Lake.

An additional 5,074 were marked by adipose fin removal at the hatchery, and were stocked in Birch Lake on June 5. The June 5 stocking was marked to prepare for a stocking survival estimate. Because fish marked and released along the shoreline during the summer of 1979 failed to mix with the unmarked population (thus rendering any population estimate invalid), the 5,074 fish stocked on June 5 were released into the center of the lake in an attempt to disperse them evenly throughout the population of fish stocked on May 23.

Seining on June 9, 10, 11, and 20 showed that, as in 1979, the marked fish failed to mix with the unmarked population rapidly enough to obtain an estimate.

In late September and early October, fyke netting and electrofishing produced a population estimate of the yearling rainbow trout. From September 23 to 26, three fyke nets produced 1,319 yearlings and night shocking produced 738, for a total of 2,057 marked fish. The fish were allowed to mix, and the fyke nets were used again to monitor the recapture rate on September 29, September 30, and October 8. During this period, 1,572 fish were inspected for marks and the recapture rate ranged from 4.6 percent to 7.8%.

All of the data combined yielded a Schnabel estimate of 29,652 fish, with a 95% confidence interval of 25,784 to 35,419 fish. This represents a survival to the fall of 53.8% of the 55,074 rainbow trout stocked in early summer, compared to the 20.8% survival of the 101,314 Ennis-Alaska strain rainbow trout stocked in 1979. As in 1979, darkness and cooler water contributed to the success of the late fall effort.

#### Rainbow Trout Growth:

The Swanson yearlings were sampled for length twice during the open water season. During the summer, the mean length increased by 39 mm; it was 130

Table 5. Miscellaneous information about Birch Lake fishery, summers of 1979 and 1980.

	1979	1980
Percent anglers fishing from shore	24	28
Percent of total catch from shore	21	34
Catch per hour from shore	0.26	0.31
Percent anglers fishing from boats	76	72
Percent of total catch from boats	79	66
Catch per hour from boats	0.30	0.31
Percent of anglers who were military	34	49
Percent of total catch by military anglers	24	52
Catch per hour for military anglers	0.26	0.32
Percent of anglers who were civilian	66	51
Percent of total catch by civilians	76	48
Catch per hour for civilians	0.26	0.25

Table 6. Ratios of Age I Birch Lake rainbow trout kept and released by anglers through the summer of 1980, and length data.

Month	Ratio Kept : Released	% Kept	Fork Length mm	
			Mean	Range
May - June	1:8.7	10.3	140	104-195
July	1:2.7	27.1	...	
Aug. - Sept.	5:1	83.3	179	136-233



mm at stocking and 179 mm by late September. This contrasts with the 88 mm average increase of the Ennis-Alaska sub-catchables in the summer of 1979 (Table 7).

Swanson yearlings were sampled five times for lengths and weights through the summer and fall to compute condition factors (K). A comparison of mean condition factors (Table 8) confirms the field observation that Ennis-Alaska rainbow trout are deeper-bodied and broader at a given length than Swanson rainbows. Condition factors demonstrated similar trends in both strains--increasing from May until July, declining in August, and increasing again by early October.

The mean fork length of fourteen Age II Ennis-Alaska rainbow trout taken in late July and early August, 1980, was 232 mm. This represents an increase of 17 mm from the mean length of 215 in October-November 1979.

#### Popeye Disease:

Rainbow trout were examined through late summer for symptoms of the popeye disease that appeared in Birch Lake rainbow trout stocks in summer 1979 (Doxey, 1980). Of 18 Age II Ennis-Alaska fish examined from July 21 to August 13, 12 (66%) showed the bloated bodies, rough scales, and popeyed appearance seen in 1979. None of the Age I Swanson fish showed any symptoms of the disease at any time.

#### Coho Salmon:

In spring 1980 there were no coho salmon in Birch Lake. On May 27, 1980, 59,850 coho salmon averaging 160 per pound were stocked into the lake. Field observations indicated good survival. At the time of stocking, the mean fork length of the salmon was 63 mm and the mean weight was 2.82 g. By late September, the mean fork length had increased to 112 mm (range 102-127 mm) and the mean weight was 19 g. These fish should be contributing significantly to the creel by fall-winter 1981.

#### Lake Chubs:

Attempts to trap lake chubs for removal from the lake during summer 1980 resulted in catches of chubs mixed with significant numbers of recently stocked coho salmon. Separating the two species to retain chubs and return the salmon to the water was time-consuming. It appears that trapping and physical removal of chubs is not feasible in years when coho fingerlings are present in the lake.

When large rainbow trout are present in fyke nets with chubs, the trout will eat the chubs. Rainbow trout predation is probably not a significant control on the chub population, however. Chubs (particularly small ones) inhabit dense weedbeds. Rainbows hunt along the edges of dense cover, but will seldom enter it in search of prey (Satterthwaite, 1978); therefore, habitat preferences probably make the majority of the chubs unavailable to rainbow trout as food items through the summer.

Table 7. Growth comparison of Age I Swanson and Ennis-Alaska strain rainbow trout-Birch Lake-May to October.

Strain	Date	Length (MM)		Average Growth (mm)	n
		Mean	Range		
Ennis-Alaska	May, 1979	127	80-160		6
Swanson	May, 1980	130	94-195		95
Ennis-Alaska	Oct.-Nov., 1979	215	181-250	88	66
Swanson	Oct., 1980	179	136-233	39	41

Table 8. Mean condition factors for Birch Lake Age I Ennis-Alaska rainbow trout in 1979 and Swanson rainbow trout in 1980.

Month	Condition Factor	
	Ennis-Alaska	Swanson
May	1.2294	1.0397
June	...	1.1049
July	1.2518	1.1568
August	1.2485	1.1223
September	...	...
October	1.3689	1.1333

The tapeworm Ligula intestinalis was identified in Birch Lake chubs in 1979 (Doxey, 1980). The rate of infestation of chubs by L. intestinalis in June 1979 was thought to be lower than actually occurred later in the summer, so in August 1980 another sample of chubs was examined. Of 90 chubs autopsied, 29 (32%) had visible tapeworms in the body cavity. Infestation results in death within 1 1/2 years. The high rate of tapeworm infestation, coupled with the observation that there are few chubs older than Age III, indicates that L. intestinalis may be retarding the growth of the chub population in Birch Lake.

#### Limnological Data:

Daily water temperatures recorded in a nearshore area by a Ryan thermograph were averaged by week and are presented in Figure 2. Table 9 presents temperature and dissolved oxygen profiles taken during the summer. Rainbow trout again appeared to prefer nearshore areas with aquatic vegetation, as they did in 1979 (Doxey, 1980). The summer high surface water temperature was 72°F, recorded on July 24. The Swanson rainbow trout appeared to suffer no deleterious effects from the warm water, in contrast to the Ennis-Alaska fish, which developed the warm water-related popeye disease.

#### Harding Lake

Harding Lake was test netted from October 12 to October 21. Seventeen net nights of effort produced least cisco, coho salmon, and small numbers of northern pike and burbot.

Least cisco appeared to be recovering from the population decline described by Hallberg (1979). Gillnets set in the shoals at the north end of the lake produced small numbers of adult, spawning least ciscos (2-5 per net night). However, the 1/2 in mesh panels of the nets produced large numbers of 130 mm male ciscos (up to 152 per net night). Most of these fish were Age I and in spawning condition. This is the first time that Age I least cisco have been seen to spawn in Alaska (Ken Alt, pers. comm.). Ciscos normally mature in Harding Lake at Age III. The small ciscos were distributed around the entire lake, whereas the larger, older ciscos concentrate at the north end of the lake in the fall.

The cisco population is making its recovery in the face of continued predation by stocked coho salmon. That predation is about to end, however, as there is only one age class of immature coho salmon in the lake, and they will die in the winter of 1981-1982.

Two net nights in a location favored by coho salmon produced a total of nine mature, terminal year cohos. Their length range was 510 to 613 mm with a mean length of 558 mm. Their weight range was 1,588 to 2,608 gm, and their mean weight was 2,104 gm. Cohos contributed little to the creel in 1980.

The mean length of 24 burbot taken primarily by setline from December 2, 1979 to November 23, 1980 was 633 mm, with a length range from 510 to 814 mm. Their weight ranged from 680 to 3,856 gm with a mean weight of 2,098

FIGURE 2

AVERAGE WEEKLY SURFACE WATER TEMPERATURES  
BIRCH LAKE 1980  
NEARSHORE AREA

SUMMER HIGH WAS 72° RECORDED  
OFFSHORE ON 7/24.

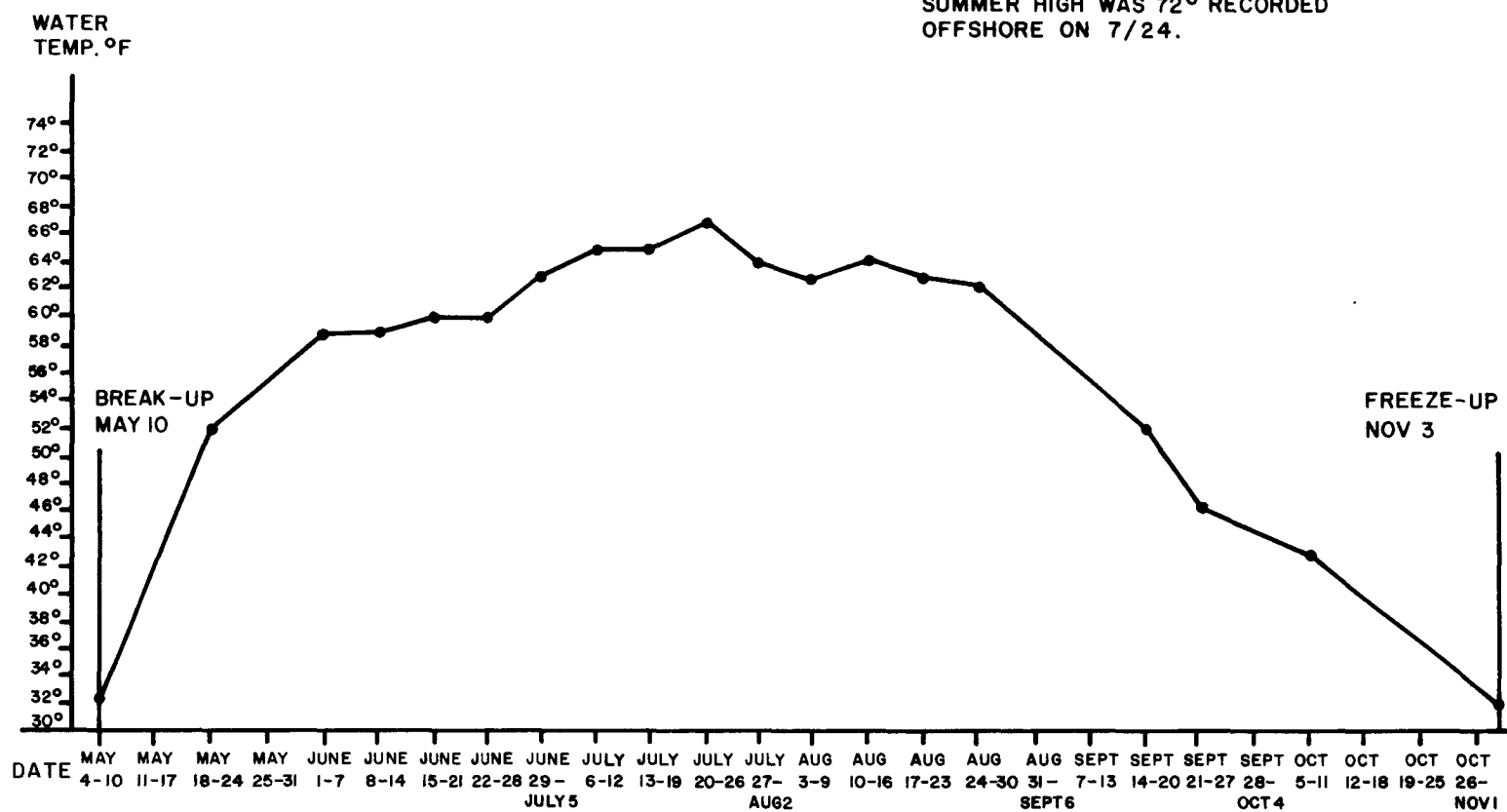


Table 9. Dissolved oxygen and temperature profiles - Birch Lake, 1980.

Date	Habitat	Depth (ft)	Temperature (°F)	D.O. (ppm)
June 28, 1980	Outer edge of lily pads, west end of lake	Surface	62	8
		5	61	7.9
		8 (bottom)	61	7.8
June 28, 1980	Deeper water off same shoreline	Surface	62	8.2
		5	62	7.4
		10	61	7.9
		15	58	7
		18 (bottom)	50	5.8
July 24, 1980	Off western shore, over deep weedbeds	Surface	72	8.0
		5	70	7.9
		9 (bottom)	70	7.8
July 24, 1980	Western shoreline off deep weedbeds	Surface	70	8.1
		5	70	8.1
		10	67	7.9
		15	64	7.2
		17	64	...
		19 (bottom)	57	5.2
July 24, 1980	Off western shore- line, deep water	Surface	70	8.3
		5	70	8.3
		10	68	8.3
		15	64	7.4
		20	54	5.2
		25 (bottom)	49	3.9
July 24, 1980	Off western shore- line, in middle of lily pad beds	Surface	70	8.0
		2	70	7.9
		4	70	7.7
		6	69	8.2
July 24, 1980	Western shoreline, nearshore along inner margin of lily pads	Surface	71	8.2
		1 1/2	71	7.8
		3	70	8.9
October 7, 1980	Off western shoreline	Surface	43	10.2
		5	43	10.0
		9	43	9.2

gms. Harding Lake burbot are the subject of a fairly intensive fishery immediately after freeze-up. They appear to move into shoal areas in pursuit of spawning ciscos, and are taken readily on set lines in these areas until mid-December, when fishing slows down. Small numbers of burbot are taken throughout the the rest of the year by anglers.

#### Lost Lake

Lost Lake was sampled twice in 1980 to determine the status of stocked coho salmon. One net night of effort on June 12 produced three salmon from the 1977 stocking. Their lengths ranged from 244 to 300 mm, with a mean length of 274 mm. The net also yielded approximately 200 cohos from the 1979 stocking. These fish ranged from 119 to 134 mm in length, with a mean length of 127 mm. Their weight range was 19 to 26.5 g, with a mean of 22 g.

On May 27, 1980, 19,990 cohos at 216/lb were stocked in Lost Lake. On December 5, 1980, 1 1/2 hours of angling produced 11 cohos from three stockings. Two cohos from the 1977 plant were 212 and 214 mm long, and were sexually mature fish in spawning condition. Five fish from the 1979 stocking were from 126 to 140 mm in length, with a mean length of 132 mm. Four cohos from the 1980 plant ranged from 79 to 101 mm in length, with a mean length of 94 mm. Survival of stocked cohos in Lost Lake is good, but growth is slower than in some of the other lakes.

#### Koole Lake

Koole Lake was stocked with 42,927 Talarik strain rainbow fingerlings at 413 per lb on July 23, 1980. Their mean length was 46 mm, and their mean weight was 1 g. In late August a short trip was taken to Koole Lake to assess the rainbow populations. Four net-hours with a 125 foot experimental gillnet produced four trout, and angling produced one more and consistent strikes. All five fish were from the 1974 plant. Their length range was from 340 to 485 mm, with a mean length of 437 mm. Weights ranged from 900 to 1,600 g, with a mean of 1,340 g. These figures represent a mean growth of 47 mm and an increase of 640 g from the mean lengths and weights of the fish sampled in 1979 (Doxey, 1980).

The increase would have been greater, but the smallest fish taken in 1980 appeared to be stunted and probably skewed the data. The large rainbows are providing good angling potential for fly-in fishermen. None of the fish stocked in July were seen, though these fish were in excellent condition when stocked (Mike Kramer, pers. comm.). It is probable that none were seen because they were too small to be taken by the gill net and no surface feeding was occurring during the survey. None of the large trout had small ones in their stomachs.

#### "Spencer" Lake

The preliminary survey of "Spencer" Lake continued as time allowed during 1980 (Figure 3). On April 2, dissolved oxygen levels and maximum depths were determined. The ice was 31 in thick. Dissolved oxygen levels in the main part of the lake ranged from 2 to 4.5 ppm. The maximum depth is 18 ft, and there is a trough down the length of the lake in which depths range from 8 ft to 18 ft.

**FIGURE 3**  
**"SPENCER" LAKE**  
**SCALE 1" = 160 FEET**

**KEY**

- Y Y Y SWAMP
- ⊗ LILY PADS
- DEPTHS
- D.O. SAMPLING STATIONS

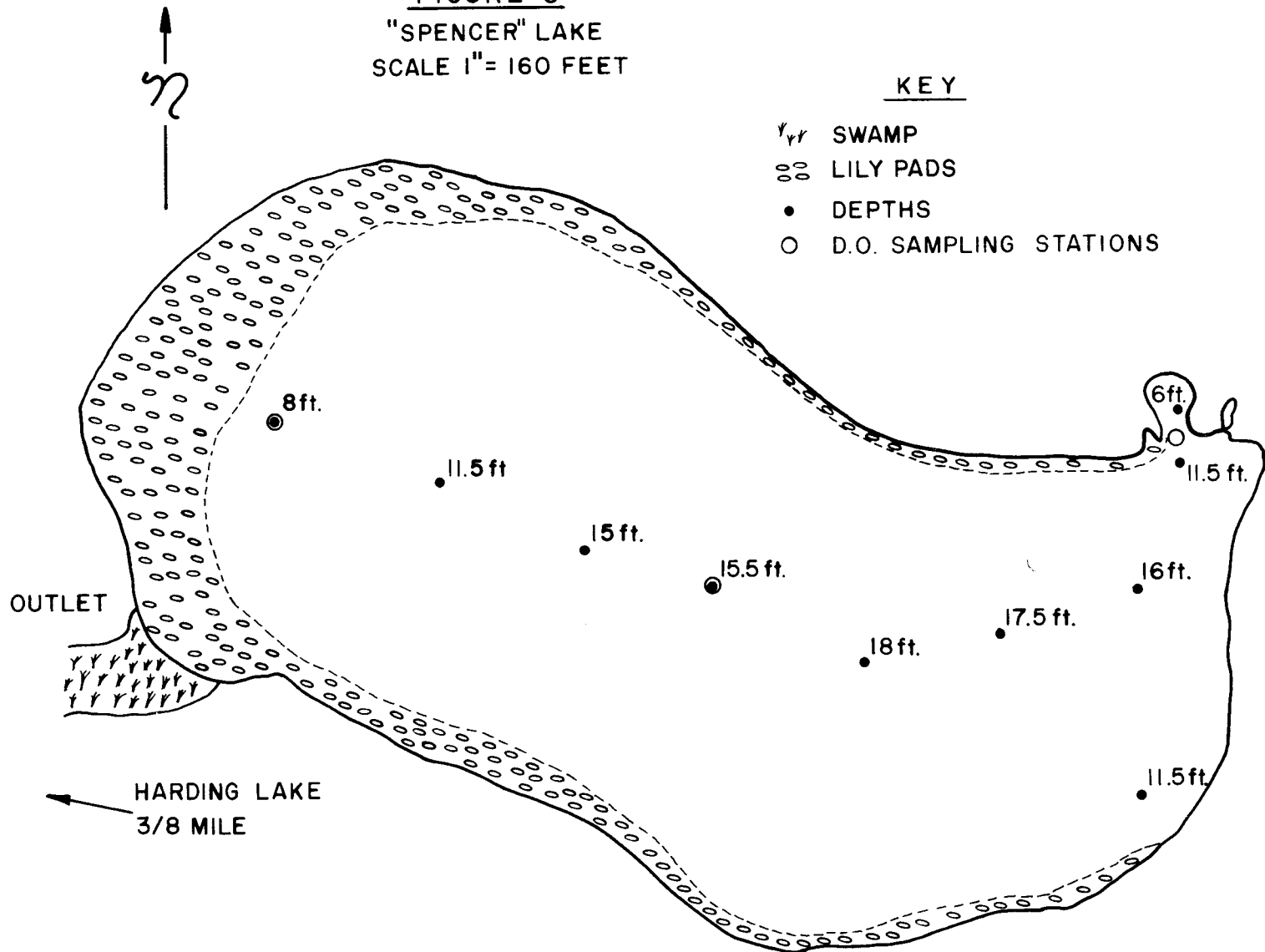


Figure 3. Spencer Lake.

Angling produced no strikes and no fish. Aquatic insects were seen in the holes through the ice.

On July 25, the outlet was surveyed to determine the necessity and size of a fish control structure. To prevent fish movement into and out of the lake during high water years, two small low spots would have to be sealed with sandbags and a gabion or weir built across 21 ft of swampy outlet. The task appears fairly simple.

#### Little Harding Lake

Little Harding Lake was netted twice and sampled by angling to determine the growth and status of stocked salmon in the lake. Good numbers of coho salmon from the 1979 stocking were taken. Growth analysis indicates that these fish grew from a mean fork length of 146 mm (range 135-169 mm) in June to a mean length of 188 mm (range 160-215 mm) in November.

A second, larger age class of salmon of unknown origin has appeared in the lake. These fish had a mean length of 255 mm in June (n=17) and a mean length of 258 mm (n=2) in October. They appeared to be cohos, and were sexually immature. Age, growth, and meristic analysis indicates that these fish are coho salmon mistakenly stocked into the lake instead of chinook salmon in 1978.

The coho salmon in Little Harding Lake provided good fishing for ice fishermen during the winter of 1980-81, with CPUE from freeze-up in late October until mid-January averaging 5.33 fish per hour.

The outlet structure of Little Harding Lake was improved in August of 1980. A dike was built to help control water level and direct overflow during high water periods, and an additional culvert was put in to handle the overflow. Screens were upgraded to prevent fish movement into and out of the lake, and to make vandalism difficult. The dike had the added benefit of providing a driveable surface to a point allowing ice fishermen easy vehicular access to the lake.



## LITERATURE CITED

- Doxey, M. 1980. Population studies of game fish and evaluation of managed lakes in the Salcha District with emphasis on Birch Lake. Federal Aid in Fish Restoration, Annual Report of Progress, 1979-1980, Project F-9-12, 21(G-III-K): pp. 26-47.
- Hallberg, J. E. 1979. Evaluation of management practices on four selected lakes of Interior Alaska. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1979-1980, Project F-9-11, 20 (G-III-J): pp. 115-134.
- Kramer, M. J. 1978. Evaluation of Interior waters and sport fish with emphasis on managed lakes - Fairbanks District. Federal Aid in Fish Restoration, Annual Report of Progress, 1977-1978, Project F-9-10, 19(G-III-H): pp. 46-62.
- Satterthwaite, T. D. 1978. An ecological analysis of the quality fishery for rainbow trout in Becker Lake. M. S. thesis, University of Arizona.
- Roguski, E. A. and P. C. Winslow. 1969. Investigations of the Tanana River and Tangle Lakes grayling fisheries: migratory and population study. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1969-1970, Project F-9-2, 10(16-B): pp. 33-351.
- Van Hulle, F. D. 1968. Investigations of the fish populations in the Chena River. Alaska Dept. of Fish and Game. Federal Aid in Fish Restoration, Annual Report of Progress, 1967-1968, Project F-5-R-9, 9: pp. 287-304.

Prepared by:

Michael Doxey  
Fishery Biologist

Approved by:

Rupert E. Andrews, Director  
Sport Fish Division

Mark C. Warner, Ph.D.  
Sport Fish Research Chief